I claim:

1. Continuous crystal plate growth apparatus comprising a source of starter material, a valve for supplying material from the starter material source, a first, hot zone communicating with the valve for heating the material, a dopant source, a dopant controller connected to the dopant source and connected to the hot zone for supplying dopant into the material in the hot zone, a second reduced heat zone connected to the hot zone for reducing heat in the material and forming a solid crystal plate from the material, a receiver connected to the reduced heat zone for receiving solid plate from the second, reduced heat zone and advancing the solid plate, a lowered temperature heating zone adjacent the receiver for lowering temperature of the solid crystal plate on the receiver, an enclosure enclosing the zones and the solid crystal plate , a controlled gaseous environment within the enclosure, and a plasma source for providing plasma to the gaseous environment.

2. The apparatus of claim 1, further comprising a large heater and a small heater, the large heater having first and second zones and the small heater having the first hot and second reduced heat zones, baffles separating the first and second zones of the heaters, and wherein the first and second zones and first hot and second reduced heat zones comprise multiple controlled zones.

3. The apparatus of claim 2, wherein the first zone of the small heater has multiple zones which produce crystal melt

temperatures higher than a crystal melting temperature of the material, wherein the second zone of the small heater has multiple zones which produces temperatures lower than the melting temperature, wherein the temperature in the material at the baffle is about the melting temperature, wherein the large heater first zone has multiple zones which provide heats to below the melting temperature, and wherein the large heater second zone has multiple heaters which provide lower heats.

4. The apparatus of claim 1, wherein the receiver and the zones relatively move at a speed equal to a crystal growth rate.

5. The apparatus of claim 1, wherein the source of starter material is a source of alkali halide, a binary, ternary or quaternary compound or a metallic compound.

6. The apparatus of claim 1, further comprising purification apparatus for the crystal starter material, comprising a chamber having a bottom and sides, a lid covering the chamber, an opening for introducing liquid or solid material into the chamber, an outlet near the bottom of the chamber for releasing crystal starter material from the chamber, a shut-off valve connected to the outlet for opening and closing the outlet, a source of reactive or inert gas or plasma connected to the chamber and extending into a bottom of the chamber, a gas release barrier near the bottom of the chamber for slowly releasing reactive gas into the crystal starter material, a gas space at the top of the chamber above the crystal starter material, an exhaust line connected to the space at the top of the chamber for

withdrawing gas from the top of the chamber, a heater adjacent the chamber for heating the chamber and the crystal starter material within the chamber, and a plasma source connected to the chamber.

7. The apparatus of claim 6, wherein the heater comprises multiple controlled zone heating elements around sides of the chamber.

8. The apparatus of claim 6, wherein the heater comprises multiple controlled heating elements along the walls of the chamber.

9. The apparatus of claim 6, wherein the purification apparatus is rockable or tippable and wherein the shut-off valve comprises one or more thermally activated shut-off valves.

10. The apparatus of claim 6, wherein the purification apparatus is rockable or tippable, and wherein the shut-off valve comprises one or more mechanical or electromechanical valves.

11. The apparatus of claim 6, wherein the opening further comprises an inlet conduit connected to the lid and a source of crystal starter material and reactive liquid or solid connected to the inlet conduit, and a valve connected between the source of reactive liquid or solid, and a plug connected to the conduit for plugging the conduit after adding reactive liquid or solid to the chamber.

12. The apparatus of claim 6, further comprising a plasma source connected to the chamber.

13. The apparatus of claim 6, further comprising an insulated enclosure around the chamber.

14. The apparatus of claim 6, further comprising a wall surrounding the chamber with an evacuated space between the wall and the chamber.

15. Purification apparatus for crystal starter material, comprising a chamber having a bottom and side walls, a lid covering the chamber, an opening for introducing liquid or solid material into the chamber, an outlet near the bottom of the chamber for releasing purified crystal starter material from the chamber, a shut-off valve connected to the outlet for opening and closing the outlet, a source of inert, reactive gas or plasma connected to the chamber and extending into a bottom of the chamber, a gas release barrier near the bottom of the chamber for slowly releasing inert reactive gas or plasma into the crystal starter material, a gaseous space at the top of the chamber above the crystal starter material, an exhaust line connected to the space at the top of the chamber for withdrawing gas from the top of the chamber, and multizone heaters adjacent the chamber for heating the chamber and the crystal starter material within the chamber.

16. The apparatus of claim 15, wherein the heater comprises multiple controlled zone heating elements around sides of the chamber.

17. The apparatus of claim 15, wherein the heater comprises multiple controlled zone heating elements along the bottom of the chamber.

18. The apparatus of claim 15, wherein the purification apparatus is rockable or tipple and wherein the shut-off valve comprises one or more thermally activated shut-off valve.

19. The apparatus of claim 15, wherein the purification apparatus is rockable or tippable and wherein the shut-off valve comprises one or more mechanical or electromechanical valve.

20. The apparatus of claim 15, wherein the opening further comprises an inlet conduit connected to the lid and a source of crystal starter material and reactive liquid and solid connected to the inlet conduit, and a valve connected between the source of reactive liquid or solvent, and a plug connected to the conduit for plugging the conduit after adding reactive liquid or solid to the chamber.

21. The apparatus of claim 15, further comprising a plasma source connected to the chamber.

22. The apparatus of claim 15, further comprising an insulated enclosure around the chamber.

23. The apparatus of claim 15, further comprising a wall surrounding the chamber with an evacuated space between the wall and the chamber.

24. Heating and purifying apparatus, comprising a chamber having an inlet and an outlet, a source of material connected to the inlet and a purified material discharge connected to the

outlet, an enclosure having side walls, a bottom and a top, a heater connected to the enclosure, a reactive gas source, a gas valve connected to the gas source and a gas inlet tube connected to the valve, a gas distributor mounted in the chamber near the bottom, a gas releasing plate connected to the gas distributor for releasing the reactive gas from the inlet tube and the distributor into the material in the feeding and purifying apparatus, multiple zone heaters connected to the chamber for heating material in the chamber, a gas exhaust connected to an upper portion of the chamber for exhausting gas from an upper portion of the chamber, and a plasma source connected to the chamber.

25. The apparatus of claim 24, further comprising a casing having a cover and side walls, and wherein the casing side walls comprise the chamber side walls, and insulation interposed between the casing and the chamber.

26. The apparatus of claim 24, wherein the heater comprises an upper heater having multiple zone heating elements across a top of the chamber.

27. The apparatus of claim 24, wherein the heater comprises heating elements having multiple controlled zones in a ceramic matrix extending across a bottom of the chamber.

28. The apparatus of claim 24, wherein the gas releasing plate comprises a porous quartz plate for releasing reactive gas and plasma and inert gas.

29. The apparatus of claim 24, wherein the heater comprises a radiant heater having multiple controlled zones positioned near the chamber.

30. The apparatus of claim 24, wherein the heater comprises a first top heater having heating elements with multiple controlled zones extending across the top of the chamber, and a second bottom heater having heating elements with multiple controlled zones extending across a bottom of the chamber.

31. The apparatus of claim 24, wherein the heater comprises a top heater having heating elements extending across a top of the chamber, and first and second side heaters having heating elements each having multiple controlled zones extending along sides of the chamber.

32. The apparatus of claim 31, further comprising a heater extending along a bottom of the chamber and having heating elements each having multiple controlled zones extending along the bottom of the chamber.

33. The apparatus of claim 24, wherein the heater comprises a radiant heater having multiple controlled zones spaced above the chamber for directing heat flux downward into the material in the chamber.

34. The apparatus of claim 24, wherein the bottom of the chamber comprises a relatively movable base for supporting the material.

35. The apparatus of claim 34, wherein the base and the heaters relatively move for transporting material with respect to the chamber.

36. The apparatus of claim 24, wherein the apparatus moves with respect to a stationary base for supporting a growing crystal.

37. Crystal growth apparatus comprising a support for supporting a growing crystal, a first multiple zone heater adjacent the growing crystal for heating the growing crystal and liquefying the growing crystal, a second multiple zone heater spaced from the first multiple zone heater along the growing crystal for re-liquefying the growing crystal, and a plasma source connected to the chamber.

38. The apparatus of claim 37, further comprising multiple zone heaters spaced from each other along the growing crystal for liquefying the growing crystal, and reactive gas, inert gas and plasma distributors adjacent the liquefying.

39. The apparatus of claim 37, wherein the first zone heater further comprises heating and purifying apparatus for purifying the crystal melt.

40. The apparatus of claim 39, wherein the first zone heater comprises a reactive gas distributor for distributing reactive and inert gas and plasma from near a bottom of the crystal melt.

41. The apparatus of claim 40, further comprising a liquid or solid adaptive substance source for releasing liquid or solid reactive substance into the melt.

42. The apparatus of claim 40, wherein the last multiple zone heater further comprises a source of dopant connected to the heater for supplying dopant into the crystal melt.

43. The apparatus of claim 40, wherein the support comprises a movable support for moving the liquid crystal along zone heaters.

44. The apparatus of claim 40, wherein the zone heaters move along the crystal.

45. Crystal growth apparatus comprising a chamber for holding a crystal melt, a crystal support holding a crystal movable with respect to the chamber for forming a bottom of the chamber with the crystal, a first multiple zone heater adjacent the chamber for heating and maintaining a crystal melt within the chamber, a baffle connected to the first multiple zone heater adjacent a bottom of the chamber, a second multiple zone heater connected to the baffle beyond the first heater, a source of reactive and inert gas and plasma, a controller connected to the source of reactive and inert gas and plasma, a gas tube connected to the controller, a distributor connected to the gas tube and mounted in the chamber for positioning within the crystal melt, a gas releaser connected to the distributor for releasing reactive and inert gas and plasma into the crystal melt, and a gas exhaust

connected to the chamber for exhausting gas from the chamber above the crystal melt.

46. The apparatus of claim 45, further comprising an inlet tube connected to the chamber and a controller connected to the inlet tube for releasing reactant substance into the chamber and into the crystal melt.

47. The apparatus of claim 45, further comprising a dopant conduit connected to the chamber and a dopant source connected to the conduit for providing a dopant from the source through the conduit to the chamber.

48. The apparatus of claim 47, wherein the reactive substance and the reactive gas control the dopant.

49. The process for crystal growth, comprising holding a crystal melt in a chamber, holding a crystal in a crystal support, moving the support with respect to the chamber, forming a bottom of the chamber, heating and maintaining a crystal melt temperature within the chamber, separating heating of the chamber from a crystal by a baffle adjacent a bottom of the chamber, heating the crystal with a second heater, releasing reactive and inert gas and plasma into the crystal melt, and exhausting gas from the chamber above the crystal melt.

50. The process for heat treating crystals, comprising placing a formed and cut crystal on a platform, enclosing sides of the crystal, placing a lid on top of the crystal, applying inward force to the sides and the top to press the crystal inward, heating the crystal, increasing force on the crystal,

maintaining force and heating the crystal for a predetermined time, reducing force and reducing heat, cooling the annealed crystal and withdrawing the cooled crystal, wherein the crystal is a single crystal, polycrystalline or powdered material.

51. The process of claim 50, wherein the material being pressed has uniform material properties over the entire body, or has composition within certain sections of the body.

52. The process of claim 50, wherein the material being pressed is alkali halide material, sodium iodide, cesium iodide, calcium fluoride or barium fluoride.

53. The process of claim 49, wherein the crystal is a ternary metal fluoride compound $Ca_xBa_{1-x}F_2$ where $0 \leq x \leq 1$ or $Ca_xSr_{1-x}F_2$ where $0 \leq x \leq 1$.

54. The process of claim 49, wherein the crystal is a ternary compound or a quaternary compound.

55. The process of claim 49, wherein the crystal is silicon, silicon and germanium, Si_xGe_{1-x} solid solution, silicon and silicon carbide $Si_x(SiC)_{1-x}$, silicon and silicon dioxide $Si_x(SiO_2)_{1-x}$, silicon and any ceramic, silicon and any oxide $Si_x(Oxide)_{1-x}$, silicon and any metal Si_xM_{1-x}, silicon and any alloy Si_xA_{1-x}, or any combination thereof.

56. The process of claim 55, wherein the crystal is mixed with organic and/or inorganic substances to form a slurry, or solid substance in form of powder, shot or any size and shape material suitable for the process.

57. The process of claim 49, wherein the crystal is a composite of many compounds and the end product is an optical lens material.

58. The process of claim 49, wherein the crystal is a substance for making optical elements.

59. The process of claim 49, wherein the crystal is a scintillation oxide material.

60. The process of claim 50, wherein the heat treating is in a vacuum.

61. The process of claim 50, wherein the heat treating is in reduced pressure of one or more inert or reactive gases.

62. The process of claim 50, wherein the heating further comprises controlling the temperature distribution over heating plates.

63. The process of claim 62, wherein the temperature distribution over each heating plate is non uniform and the plates might have rectangular, polygonal, round, or oval shape temperature distribution for process control.

64. Purification apparatus for crystal starter material, comprising a chamber having bottom and side walls, a lid covering the chamber, an opening for introducing liquid or solid material in the chamber, an outlet near or at the bottom of the chamber, a shut off valve connected to the outlet for opening and closing the outlet, a source of reactive gas connected to the chamber and extending into the chamber, a reactive gas release area extending to the near bottom of the chamber for slowly releasing reactive

gas into and above the crystal starter material, gaseous space at the top of the chamber for withdrawing gas from the top of the purified material, and a heater adjacent the chamber for heating the chamber and the crystal starter material within the chamber.

65. The apparatus of claim 64, wherein the source of reactive gas is an in-line or other plasma generator.

66. Purification apparatus for crystal starter material, comprising a reduced pressure chamber having a vacuum port and vacuum valves, a gas delivery system, heating elements for heating the contents in the chamber, a container for material to be purified and a porous distributor to distribute reactive gas within and above the material being purified.

67. The apparatus of claim 66, wherein the source of reactive gas is an in-line or other plasma generator.

68. The apparatus of claim 66, further comprising a source of reactive substance that is gaseous, liquid or solid element or compound.

69. The apparatus of claim 68, wherein the source of the reactive substance is a source of elemental gas or organic or inorganic gaseous compound or a mixture thereof in neutral or ionized state.

70. The apparatus of claim 69, wherein the source of the reactive substance further comprises a source of carrier gas.

71. The apparatus of claim 66, wherein the reactive gas is fluorine gas, F_2.

72. The apparatus of claim 66, wherein the reactive gas is fluor gas, F_2 mixed with carrier gas that is an inert gas or an inorganic or organic compound in gaseous form.

73. The apparatus of claim 72, wherein the F_2 is in its atomic state.

74. The apparatus of claim 73, wherein the F_2 in its atomic state is obtained via chemical reaction and/or passing fluorine gas through an ion generator.

75. The apparatus of claim 73, wherein the F_2 in its atomic state is mixed with carrier gas that is an inert gas or inorganic or organic compound in gaseous form.

76. The apparatus of claim 74, wherein the ion generator is a plasma generator.

77. The apparatus of claim 76, wherein in the plasma generator only part of the gas is dissociated into atoms or where some of the atoms recombine after the ionization and form neutral molecules.

78. The apparatus of claim 66, wherein the reactive gas is a mixture between fluorine atoms and fluorine molecules obtained through two different sources and combined for purification purposes.

79. The apparatus of claim 78, wherein the reactive gas mixture is mixed with carrier gas that is an inert gas or an inorganic or organic compound in gaseous form.

80. The apparatus of claim 66, wherein the reactive gas is carbon tetrafluoride, CF_4.

81. The apparatus of claim 66, wherein the reactive gas is carbon tetrafluoride gas, CF_4 mixed with carrier gas that is an inert gas or inorganic or organic compound in gaseous form.

82. The apparatus of claim 66, wherein the reactive gas is fluorine gas, F_2, fluorine in its atomic state and CF_4.

83. The apparatus of claim 66, wherein the reactive gas is CF_4 gas, ionized CF_3 radicals, and fluorine in its atomic and molecular state obtained via chemical reaction and/or passing fluorine gas through an ion generator.

84. The apparatus of claim 83, wherein the ion generator is a plasma generator.

85. The apparatus of claim 66, wherein the reactive gas is a mixture between carbon tetrafluoride, carbon tetrafluoride radicals such as CF_3 or other, fluorine atoms and molecules and other fluorine organic or inorganic molecules in neutral or charged state.

86. The apparatus of claim 66, wherein the reactive gas is a mixture between carbon tetrafluoride, carbon tetrafluoride radicals such as CF_3 or other, fluorine atoms and molecules and other fluorine organic or inorganic molecules in neutral or charged state and/or their ions created by passing them through an ionization apparatus.

87. The apparatus of claim 66, wherein the reactive gases are selected from bromine, bromine-based compound, chlorine, chlorine-based compounds, hydrogen, hydrogen-based compounds, and mixtures thereof.

88. The apparatus of claim 66, further comprising reactive solids selected from metal fluorides, ZnF_2, PbF_2, and inorganic or organic compounds that incorporate them.